PROBLEMS AND SOLUTIONS.

SEND ALL COMMUNICATIONS ABOUT PROBLEMS TO B. F. FINKEL, Springfield, Mo.

PROBLEMS FOR SOLUTION.

ALGEBRA.

487. Proposed by WILLIAM HOOVER, Columbus, Ohio.

Show in two ways that 0.5623 is not a root of $(1 - m)e^m = 2e^{-1}$, e being the Napierian base. Find the correct value of m, and test the result in two ways.

488. Proposed by NORMAN ANNING, Chilliwack, B. C.

Show that

$$\begin{vmatrix} a_1 & 1 & a_2 \\ 1 & 1/a_4 & 1 \\ a_2 & 1 & a_3 \end{vmatrix} = 0,$$

where

$$a_k = \frac{\sin(k\theta + \alpha)}{\sin k\theta},$$

and θ and α have any values that do not make a denominator zero.

GEOMETRY.

520. Proposed by ALBERT A. BENNETT, University of Texas.

On a given tangent to a circle determine a point such that, if a secant be drawn joining this point to the extremity of the diameter which is perpendicular to the given tangent, the segment of this secant exterior to the circle will be equal in length to a given segment.

521. Proposed by R. M. MATHEWS, Riverside, California.

A variable circle, with center on the line l and passing through a fixed point P, cuts a fixed circle in A and B. Prove that the common chord AB and the perpendicular to l through P intersect in a fixed point.

CALCULUS.

435. Proposed by B. F. FINKEL, Drury College.

Show that

$$\int_0^\infty e^{-x^2-(a^2/x^2)}dx = \frac{\sqrt{\pi}}{2e^{2a}}$$

by a transformation, rather than by the usual method of differentiating under the sign of integration, as, for example, in Byerly's *Integral Calculus*, pages 106–107.

436. Proposed by ARTEMAS MARTIN, LL.D., Washington, D. C.

A circle of radius a is drawn at random on a circular slate of radius r. If another circle of radius a be drawn on the slate, what is the probability that the second circle will intersect the first?

MECHANICS.

352. Proposed by C. N. SCHMALL, New York City.

A glass rod is balanced partly in and partly out of a cylindrical tumbler, with its lower end resting against the vertical wall of the tumbler. If ϕ and ψ are the maximum and minimum angles, respectively, which the rod can make with the vertical plane, and θ is the angle of friction, show that

$$\theta = \tfrac{1}{2}\tan^{-1}\left(\frac{\sin^3\phi - \sin^3\psi}{\sin^2\phi\cos\phi + \sin^2\psi\cos\psi}\right).$$